

Short paper

Raptor migration at Antikythira, in southern Greece

Abstract We document the first systematic survey of the spring and autumn migration of raptors along the central-eastern Mediterranean flyway, from observations on Antikythira, in southern Greece. More raptors were observed in autumn than in spring, mainly due to the much greater autumn passage of adult Honey-buzzards *Pernis apivorus*. Results suggest that the entire Greek population of Black Kites *Milvus migrans* uses this flyway. Our observations of Short-toed Eagles *Circaetus gallicus* suggest that adults breeding in southern and central Greece avoid Antikythira and follow a circuitous migration via the Bosphorus or Dardanelles, while some juveniles in autumn appear to attempt a sea crossing via Crete to Libya.

Most raptors that breed in Europe and winter in Africa tend to avoid crossing the Mediterranean during migration, which leads to the well-known concentrations at the Bosphorus and Strait of Gibraltar. However, some species with relatively long wings (chiefly Honey-buzzard *Pernis apivorus*, Marsh Harrier *Circus aeruginosus* and Black Kite *Milvus migrans*) regularly cross the central Mediterranean using powered flight, negotiating sea crossings of between 150 and 500 km between central-southern Italy and North Africa (Agostini *et al.* 2000; Sammut & Bonavia 2004; Agostini

& Panuccio 2005, 2010).

In contrast to the central Mediterranean flyway, little is known of raptor movements between Greece and North Africa, although Handrinos & Akriotis (1997) suggested that the Peloponnese–Crete flyway may be an important route. The aim of this study was to provide the first systematic survey of migrating raptors using this flyway.

Study area and methods

Antikythira (35°52'N 23°18'E; fig. 1) is a small island in the Sea of Crete, 32 km south-east of Kythira and 33 km northwest of Crete.



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135. Sunrise over the watchpoint on Antikythira, with Kythira in the far distance; October 2009.

Sporadic observations in recent years had suggested that its location, along the central-eastern Mediterranean flyway, makes it attractive to migrant birds (Kominos unpublished data). Systematic counts were made during both spring and autumn, from a single observation point. In spring, counts were made from 25th April to 15th May 2007 and from 16th April to 14th May 2008 (a total of 410 hours of observation). In autumn, counts were made from 24th August to 20th September 2007, 21st August to 20th September 2008 and 4th September to 20th October 2009 (925 hours in total).

Other surveys of raptor migration, including those cited above, show that birds using islands as a stopover site are a source of potential bias, so birds seen hunting or in 'reverse migration' were subtracted from our counts. We also attempted to distinguish adults and juveniles and, where possible, (adult) males and females. For Marsh Harriers, the number of adult females and juveniles was estimated by allocating unidentified female/immatures between the two age groups according to their proportion among identified birds (Kjellén 1992; Agostini & Logozzo 2000).

Results

Spring

In spring, migrating raptors typically approached from the southeast, presumably via Crete, and disappeared towards Kythira to the northwest. A total of 385 migrant raptors was recorded in spring 2007 and 412 in 2008 (table 1). Fifteen raptor species were logged, of which Common Buzzard *Buteo buteo* (max. 129 on 24th April 2008), Honey-buzzard (max. 32 on 5th May 2007) and Marsh Harrier were the most numerous. Adult Honey-buzzards markedly outnumbered juveniles, while the reverse was true for Common Buzzards (table 1).

Autumn

In autumn, raptors arrived from the northwest and departed to the southeast and a total of 1,494 was counted in 2007, 1,789 in 2008 and 823 in 2009 (table 1). Seventeen species were recorded in 2007, 15 in 2008, and 22 in 2009; Honey-buzzard (max. 387 on 24th August 2008), Marsh Harrier (max. 63

on 11th September 2008) and Black Kite (max. 47 on 28th August 2007) were the most numerous species overall.

Discussion

Our results confirm that a small but significant passage of raptors occurs along the Peloponnese–Crete flyway during spring and autumn.

As expected, few of the broad-winged raptors that use thermals to assist their migration were recorded on Antikythira, even though important populations of several species breed in Greece: Levant Sparrowhawk *A. brevipes* (1,000–2,000 pairs), Short-toed Eagle *Circaetus gallicus* (300–500 pairs), Long-legged Buzzard *B. rufinus* (200–300 pairs), Egyptian Vulture *Neophron percnopterus* (100–150 pairs), Lesser Spotted Eagle *Aquila pomarina* (67–90 pairs) and Booted Eagle *A. pennata* (50–100 pairs) (these and other population estimates from BirdLife International 2004). Of these, only Booted Eagle was observed on migration in anything more than a tiny fraction of the numbers breeding in Greece. For most of these species, the few records from Antikythira may be of short-distance migrants (birds breeding on the Greek mainland and wintering in Crete) and/or inexperienced juveniles moving south using their innate compass.

In contrast, good numbers of Common Buzzards were counted on migration (table 1) in relation to the resident breeding population in Greece (3,000–5,000 pairs). These migrants, however, may not originate primarily from Greece: movements of this species have been seen over mainland Greece in both spring and autumn and, of 20 ringed birds recovered in Greece, 14 were ringed in Finland (Handrinos & Akriotis 1997).

The small number of falcons and Ospreys *Pandion haliaetus* recorded on Antikythira probably reflects the fact that they are less attracted to islands during sea crossings, being equipped to migrate using powered flight and thus across a broad front (Kerlinger 1989).

Recent studies in the central Mediterranean have shown evidence of age-dependent migration behaviour in Short-toed Eagles. Breeding birds from

Table 1. Number of raptors observed on Antikythira, southern Greece, during spring migration in 2007 and 2008, and autumn migration in 2007–09. In cases where it was possible to sex adult birds, the left-hand number in the 'Adult' column refers to males and the right-hand number to females; where sexing was not possible but birds could be accurately aged, the total number of adult and juvenile birds are given separately. Observation periods were 25th April to 15th May 2007; 16th April to 14th May 2008; 24th August to 20th September 2007; 21st August to 20th September 2008; and 4th September to 20th October 2009.

	Spring 2007			Spring 2008			Autumn 2007			Autumn 2008			Autumn 2009		
	Total	Adult	Juv	Total	Adult	Juv	Total	Adult	Juv	Total	Adult	Juv	Total	Adult	Juv
Honey-buzzard <i>Pernis apivorus</i>	101	39	1	34	15		1,131	322	35	1,348	301	61	134	12	86
Black Kite <i>Milvus migrans</i>	15	1	4	10	6		77	5		76	11	10	18	1	1
Egyptian Vulture <i>Neophron percnopterus</i>	-			-			1	1		10	2	8	5	1	4
Short-toed Eagle <i>Circus galliacus</i>	3	1		-			-			-			28		27
Marsh Harrier <i>Circus aeruginosus</i>	31	4, 5	18	59	12, 22	24	172	45, 22	70	244	59, 50	72	255	85, 61	75
Hen Harrier <i>Circus cyaneus</i>	-			1		1	-			2	2		1		1
Pallid Harrier <i>Circus macrourus</i>	2	0, 1	1	1	0, 1		2	1, 1		-			2	2, 0	
Montagu's Harrier <i>Circus pygargus</i>	6	1, 1	3	2	0, 2		3	3, 0		3	1, 1	1	11	1, 3	7
Unidentified small harrier	6	- , 1	3	1	0, 1		3	0, 1	2	6	- , 1		3		
Northern Goshawk <i>Accipiter gentilis</i>	-			-			-			2		2	2		2
Eurasian Sparrowhawk <i>Accipiter nisus</i>	-			3	- , 2		9	- , 3		14	3, 9	1	145	9, 15	38
Levant Sparrowhawk <i>Accipiter brevipes</i>	1			-			1	1		-			44	1, -	7
Unidentified sparrowhawk	-			-			6			1			5		
Common Buzzard <i>Buteo buteo</i>	187	4	35	282	2	47	10	1	1	55	16	14	105	11	11
Steppe Buzzard <i>Buteo b. vulpinus</i>	1			1			3			-			-		
Long-legged Buzzard <i>Buteo rufinus</i>	4		3	2		1	1			1			5	1	
Unidentified buzzard	-			-			-			5			-		
Greater Spotted Eagle <i>Aquila clanga</i>	-			-			-			-			1		1
Lesser Spotted Eagle <i>Aquila pomarina</i>	-			-			2	1		2	2		5	1	1
Booted Eagle <i>Aquila pennata</i>	4	1	1	4			20	1		10	1	2	32		19
Eastern Imperial Eagle <i>Aquila heliaca</i>	-			1		1	-			-			1		1
Osprey <i>Pandion haliaetus</i>	-			2	2		4		1	5			1		1
Lesser Kestrel <i>Falco naumanni</i>	-			-			1	1, 0		-			4	4, 0	
Common Kestrel <i>Falco tinnunculus</i>	-			-			-			-			2		
Red-footed Falcon <i>Falco vespertinus</i>	21	4, 6		6	4, 1		-			-			5		5
Hobby <i>Falco subbuteo</i>	1		1	3	2		1	1		2	2		4		3
Saker Falcon <i>Falco cherrug</i>	2			-			1	1	1	1	1		-		
Unidentified raptor	-			-			46			2			5		
Total	385			412			1,494			1,789			823		

central Italy reach African wintering grounds via the Strait of Gibraltar, while juveniles head south in the opposite direction via the Sicilian Channel. The interpretation here is that inexperienced birds use the shorter, but more costly (in terms of the energy needed for a sea crossing) and/or hazardous route (Agostini *et al.* 2002, 2004, 2009; Premuda 2004). Our results from Antikythira suggest that most broad-winged raptors from central and southern Greece, both adults and juveniles, opt for the more conservative route. To avoid the long sea crossing to Africa via Antikythira

and Crete most prefer the (longer) eastern flyway via the Bosphorus and/or the Dardanelles, where they can minimise energy expenditure by exploiting thermals. (A spring survey at Dadia National Park, c. 80 km northwest of the Dardanelles, reported 2,030 raptors of 23 species in three seasons (2003–05), including 136 Short-toed Eagles, and it was assumed that these migrants crossed into Europe at the Dardanelles; Schindler *et al.* 2009.) It is interesting to note that Short-toed Eagles were seldom recorded on Antikythira. In autumn 2009, easily the best of the five study seasons, 28 were seen, all in October; 27 were juveniles and the remaining bird was not aged, intimating that there may be age-related differences in migration strategy of this species among the Greek population too, at least in some years.

The higher overall numbers of migrants recorded on Antikythira during autumn is almost entirely due to the passage of adult Honey-buzzards, which peaked in late August. These birds probably cross the Mediterranean between Crete and Libya (c. 300 km), then continue on to wintering sites in central-western equatorial Africa. We assume that most if not all of these Honey-buzzards are from the Greek breeding popu-



Fig. 1. The location of Antikythira (A = Antikythira, K = Kythira, P = Peloponnesus).

lation of 1,000–2,000 pairs. More generally, it is likely that most of the raptors recorded migrating through Antikythira are from Greek breeding populations and we assume that the entire Greek population of Black Kites (some 5–20 pairs) uses this flyway.

As in other studies, we found that adult male Marsh Harriers outnumbered adult females in autumn (table 1). Although the majority of males are thought to winter in Africa, many females winter in western and southern Europe, including Greece (Agostini & Panuccio 2010). This may reflect the fact that the larger females are better able to survive in colder latitudes in winter (Agostini & Logozzo 2000; Panuccio *et al.* 2005).

Acknowledgments

We thank Theodoros Kominos, Rafael Romero, Christos Barboutis, Colin Turvey, Jakob Pohacker, Joris Driesen and Costa Karouta for their help during observations. This is contribution No. 3 from Antikythira Bird Observatory/Hellenic Ornithological Society.

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136. Juvenile Short-toed Eagle *Circaetus gallicus* over the watchpoint on Antikythira, October 2009.

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Giuseppe Lucia, MEDRAPTORS (Mediterranean Raptor Migration Network,

www.raptormigration.org), Via Carlo Alberto n°4, 89046 Marina di Gioiosa Jonica, Italy

Nicolantonio Agostini and Michele Panuccio, Università degli Studi di Pavia, Dipartimento di Biologia Animale, Via Ferrata 1, 27100 Pavia, Italy; e-mail nicolantonioa@tiscali.it

Ugo Mellone, Grupo de Zoología de Vertebrados (CIBIO) – Universidad de Alicante, Apdo. Correos 99, E-03080, Alicante, Spain

Gianpasquale Chiatante, Diego Tarini and Angelos Evangelidis, Antikythira Bird Observatory, Hellenic Ornithological Society, Vasileos Herakliou, 10162 Athens, Greece

Michele Panuccio



137. Juvenile Honey-buzzards *Pernis apivorus* over Antikythira, September 2009.